

## Claims

- [1] 1. A three-dimensionally networked silica composed of silica particles of 0 to 100 nm combining by bridge chains of aliphatic, aromatic, polyimine, peptide, and polyether groups.
2. A three-dimensionally networked silica according to claim 1, wherein the length of bridge chains is ranged in 0.5 to 100 nm.
3. A three-dimensionally networked silica according to claim 1, wherein the content of bridged chains per silica is ranged in 0.1 to 1.5 mmol/g.
4. A three-dimensionally networked silica according to claim 1, wherein the combining reactions are carried out in toluene, xylene, octane, butanol as solvents at 40 to 150°C with refluxing.
5. A three-dimensionally networked silica according to claim 1, wherein silica particles are combined by reacting silane-coupled silica particles coupled with trialkoxy silane having an amine substituent and another silica particles coupled with trialkoxy silane having a glycidyl substituent.
6. A three-dimensionally networked silica according to claim 5, wherein the reacting pairs are amine and chloride, glycidyl and mercapto, glycidyl and hydroxyl, and amine and mercapto groups.
7. A three-dimensionally networked silica according to claim 5, wherein the coupling reactions between silica particles and silane and between silane-coupled silica particles are carried out in toluene by refluxing.
8. A three-dimensionally networked silica according to claim 5, wherein the silane having an amine substituent is 3-aminopropyltriethoxy silane and the silane having a glycidyl substituent is 3-glycidyloxypropyltrimethoxy silane.
9. A three-dimensionally networked silica according to claim 5, wherein the silane having an amine substituent is 3-aminopropyltriethoxy silane and the silane having a chloride substituent is 3-chloropropyltrimethoxy silane.
10. A three-dimensionally networked silica according to claim 5, wherein the silane having a mercapto substituent is 3-mercaptopropyltrimethoxy silane and the silane having a chloride substituent is 3-chloropropyltrimethoxy silane.
11. A three-dimensionally networked silica according to claim 5, wherein the silane having a mercapto substituent is 3-mercaptopropyltrimethoxy silane and the silane having a glycidyl substituent is 3-glycidyloxypropyltrimethoxy silane.
12. A three-dimensionally networked silica according to claim 1, wherein silica

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particles are combined by reacting silane-coupled silica particles with connecting materials with multifunctional groups on their ends in toluene by refluxing.

13. A three-dimensionally networked silica according to claim 12, wherein the connecting materials are diamines, dichlorides, diisocyanates and dicarboxylic acids with methylene chains of  $C_6-C_{100}$ .

14. A three-dimensionally networked silica according to claim 12, wherein silica particles are combined by reacting silica particles with dichlorides having methylene chains of  $C_6-C_{100}$  in toluene by refluxing.

15. A three-dimensionally networked silica according to claim 12, wherein connecting materials are diisocyanato having methylene chains of  $C_6-C_{100}$ .

16. A three-dimensionally networked silica according to claim 12, wherein the silane having an amine substituent is 3-aminopropyltriethoxy silane and the connecting material is dichloro, dibromo or diiodoalkane with the methylene skeletal of  $C_6-C_{40}$ .

17. A three-dimensionally networked silica according to claim 12, wherein the silane having an mercapto substituent is 3-mercaptopropyltrimethoxy silane and the connecting material is dichloro, dibromo or diiodoalkane with the methylene skeletal of  $C_6-C_{40}$ .

18. A three-dimensionally networked silica according to claim 12, wherein the silane having a glycidyl substituent is 3-glycidyloxypropyltrimethoxy silane and the connecting material is diamino or diisocyanato alkane with the methylene skeletal of  $C_6-C_{40}$ .

19. A three-dimensionally networked silica according to claim 12, wherein the silane having a glycidyl substituent is 3-glycidoxypopyltrimethoxy silane and the connecting material is polyethyleneimine with molecular weight 600-30,000.

20. A three-dimensionally networked silica according to claim 19, wherein the skeletal of connecting materials is polyether of  $C_6-C_{50}$ .

21. A three-dimensionally networked silica according to claim 1, wherein silica particles are combined by reacting, silica particles are directly reacting multi-functional connecting materials in toluene by refluxing.

22. A three-dimensionally networked silica according to claim 21, wherein the multifunctional connecting materials are dichlorides with the methylene skeletal of  $C_6-C_{40}$ .

23. A three-dimensionally networked silica according to claim 21, wherein the multifunctional connecting materials are diisocyanates with the methylene

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skeletal of C<sub>6</sub>-C<sub>40</sub>.

24. A three-dimensionally networked silica according to claim 5, wherein the non-reacted amine groups are inactivated by reacting with chloroalkane with C<sub>12</sub> in toluene with refluxing.

25. A three-dimensionally networked silica according to claim 5, wherein the non-reacted amine groups are inactivated by reacting with monochloro or dichloro acetic acid.

26. A three-dimensionally networked silica according to claim 5, wherein the non-reacted glycidyl groups are inactivated by reacting with aminoalkane with C<sub>12</sub> in toluene with refluxing.

27. A three-dimensionally networked silica according to claim 6, wherein the non-reacted chloride groups are inactivated by reacting with aminoalkane with C<sub>12</sub> in toluene with refluxing.

28. A three-dimensionally networked silica according to claim 1, which is an additive with 5 to 100 phr to reinforce tensile and mechanical properties of rubber compounds composed of zinc oxide, stearic acid, curative accelerator, activator, processing oil, stabilizers and retarder.

29. A three-dimensionally networked silica according to claim 28, which is an additive for rubber compounds composed of diene rubber, natural rubber, butadiene rubber, styrene-butadiene rubber and butyl rubber as base rubber.

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